



Development of an Integrated In-Situ Remediation Technology



Developer: Monsanto Co.
Contract Number: DE-AR21-94MC31185
Crosscutting Area: N/A

Subsurface
Contaminants
FOCUS AREA

Problem:

Contamination in low-permeability soils poses a significant technical challenge to in situ remediation. Poor accessibility to the contaminants and difficulty in delivery of treatment reagents have rendered existing in situ treatments, such as bioremediation, vapor extraction, and pump and treat, rather ineffective when applied to low-permeability soils present at many contaminated sites.

contaminated soils. Electro-osmosis is a well known civil engineering technique for moving water uniformly through low-permeability soils without excessive power.

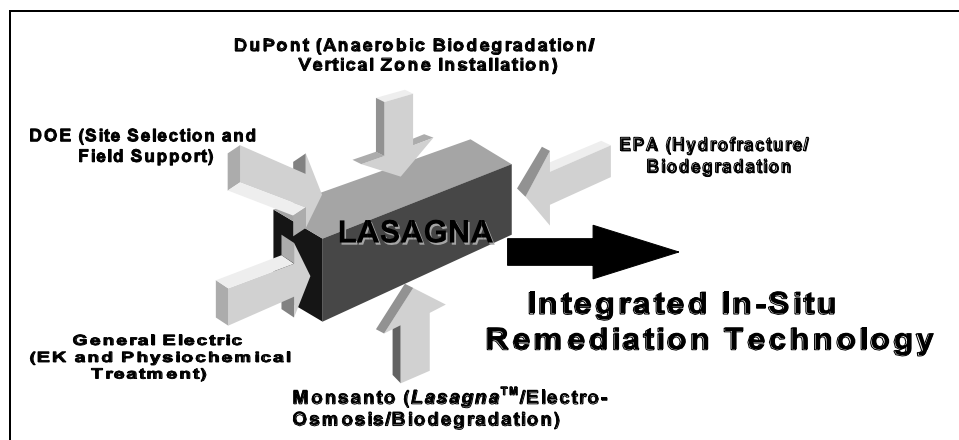
A consortium has been formed consisting of Monsanto, E. I. du Pont de Nemours & Co., Inc. (DuPont) and General Electric (GE), with participation from the Department of Energy (DOE) and the EPA Office of Research and Development and facilitation by

Benefits:

- ▶ Treatment of organic and inorganic contamination, as well as mixed wastes
- ▶ Greatly reduced environmental impacts
- ▶ Increased cost effectiveness
- ▶ Minimal waste generation
- ▶ Increased treatment flexibility
- ▶ Broad application for a wide range of sites and contaminants

Technology:

The contaminant targeted in this project was trichloroethylene (TCE). TCE is a prevalent contaminant in the nation's soil and groundwater, and is present at 60% of DOE sites. The project consisted of two major efforts: (1) development of key technologies that make up components of the integrated process, and (2) field experiments of the process at a DOE site in Paducah, Kentucky, that has clayey soil contaminated with TCE. CDM Federal



Solution:

Develop an integrated in situ remedial process which combines electro-osmosis with treatment zones established in the

Clean Sites, Inc. The overall objective of the consortium is to sufficiently develop the integrated in situ remediation technology so that it can be used for site remediation.



implemented these field experiments.

In situ decontamination can occur using Lasagna™ technology as follows:

- Create highly permeable zones in the contaminated soil region, and turn them into sorption/degradation zones by introducing appropriate materials (e.g., sorbents, catalytic agents, microbes, oxidants, buffers)
- Utilize electro-osmosis as a liquid pump for flushing contaminants from the soil into the treatment zones for degradation. Since these zones are deliberately located near one another, the time taken for the liquid to be moved by electro-osmosis from one zone to the next can be short
- Reverse liquid flow, if desired, by switching the electrical polarity. This mode may increase the efficiency of contaminant removal from the soil and minimize complications associated with long-term applications of one-directional electro-osmotic processes

Whether the electrodes and the treatment zones are horizontal or vertical depends upon the site/contaminant characteristics. In general, the vertical configuration using trenching, sheet piling, etc., is probably more applicable to shallow contamination (within 20 ft or so from ground surface), whereas the horizontal configuration using hydraulic fracturing or related methods has the unique capability for handling deep contamination.

Project Conclusion:

This project was completed in May 1996. The Lasagna™ field test at the DOE Gaseous Diffusion Plant in Paducah, Kentucky was a major success. This experiment tested the combination of electro-osmosis and in situ sorption in the treatment zones. The bulk of the TCE in the test plot was captured after just two pore volumes of water were moved between the treatment zones. After three pore volumes of water were moved, the resulting TCE removal efficiency was over 98%, with approximately 1 ppm or less remaining in the interior of the test plot area.

A full-scale demonstration of Lasagna™, complete with TCE degradation, is occurring at Paducah and is planned for completion in Fall of 1996. This demonstration may lead to a full-scale remediation of the Paducah Cylinder Drop Test Area plume based on achievement of performance and cost criteria.

Contacts:

The consortium of companies conducting this project is coordinated by Monsanto. For information on this project, the contractor contact is:

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